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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/883,981	06/20/2001	John W. Andrews	BU9-98-225 DIV	3116

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EXAMINER

BLUM, DAVID S

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 12/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/883,981

Applicant(s)

ANDREWS ET AL.

Examiner

David S Blum

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 October 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 8,15 and 23-40 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8,15 and 23-40 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

This action is in response to amendment G, paper #18, filed 10/21/03.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 8, 15, 24-32, 34-35 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zheng (US 5,728,621) in view of Liao (US 6,110,795) and Kunikiyo (US006620703B2).

Zheng teaches the device of claims 8, 15, 24-32, 34-35 and 40 except for reciting that the trench fill is "seamless" and "substantially scratch free" and co-planar with the substrate and for the doping of the trench fill. Zheng teaches the device structure of the claims in that a thin oxide layer (12) is grown, (the process mechanism is given no patentable weight in device claims) on the substrate (including the non-trench region) as in claim 34, and wide and narrow shallow trenches (figure 6) are formed on a substrate, and the trenches are filled by a non-conformal high density plasma method (18) and the filler is removed from the pad leaving trench fill in the trench and a planar surface.

Figure 7 shows the trench fill and the substrate to be co-planar as in figure 6 of the instant application. As the claims are in the format of device (structure) claims, process

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limitations are given little weight. The filler material is silicon oxide by a high density plasma method (column 3 lines 45-47). It is the high density plasma trench fill method that results in the seamless trench fill (per instant application). It is obvious that as the process steps are like, the results will be the same. Zheng is also silent as to the surface being scratchless, but teaches the trench fill may be either optionally polished or selectively etched (suggested method) to the pad layer (column 3 lines 15-25). Zheng teaches further removal of the trench fill may be optional. Figure 3 shows the high-density plasma oxide fill to be non-conformal.

Regarding claim 40, Zheng fills the trench with deposited material, thus the thickness of the deposited material is "as deposited thickness".

Liao also teaches using selective etching (not reactive ion etching) to avoid micro-scratches caused by polishing, but does not etch down to the substrate level. Thus, Zheng teaches a method which will result in the structure being substantially scratch free and Liao teaches which of the methods will yield the desired result. As defined by the specification, chatter marks are caused by CMP and by Liao teaching away from CMP to avoid micro-scratches, the lack of polishing will also eliminate chatter marks.

The limitation where the surface is planarized "without etch back" is considered a process limitation on the product and is given no patentable weight. The surface need only be planarized to be of the same structure.

Even though product-by-process claims are limited by and defined by the process, determination of Patentability is based upon the product itself. The patentability of a product does not depend on its method of production." MPEP 2113

Regarding the oxide fill being doped, Kunikiyo teaches filling the isolation trench with a doped oxide, particularly SiOF, fluorine doped silicon oxide (column 10 lines 54-55) as in claims 26 and 28. The dopant improves upon the mismatch in volumetric expansion between the fill and the silicon substrate during subsequent heating steps (column 10 lines 59-67) and reduces leak current (column 11 lines 1-5).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Zheng by choosing a removal method taught by that will result in a substantially scratch free surface as taught by Liao with reasonable expectation of producing a trench fill with a planar surface with reduced surface flaws (Zheng, background, Liao) and to use a (fluorine) doped fill as taught by Kunikiyo to improve upon the mismatch in volumetric expansion between the fill and the silicon substrate during subsequent heating steps (column 10 lines 59-67) and reduces leak current (column 11 lines 1-5).

3. Claims 23, 33, and 36-39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zheng (US 5,728,621) in view of Liao (US 6,110,795) and Kunikiyo (US006620703B2) as applied to claim 8 above, and further in view of Wolf.

Zheng and Liao teach all of the device of claims 23, 33, and 36-39 as recited above except for the upper surface of the non-trench region containing implanted dopants.

Zheng teaches the device structure of the claims in that a thin oxide layer (12) is grown (the process mechanism is given no patentable weight in device claims) on the substrate (including the non-trench region) as in claim 39, Zheng teaches at least one wide trench and at least one narrow trench. Wolf (pages 48, 58, and 522-523) teaches various transistors in a semiconductor substrate, all with implanted dopants at the upper surface of the non-trench region. On page 48, Wolf teaches Boron (as in claim 37) as the dopant. As the purpose of isolation trenches is to separate devices, including transistors, and that such devices would have dopants in the non-isolation surface, it is obvious that a complete structure would have dopants at the upper surface of the non-trench region as conventional practice.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Zheng and Liao by having dopants such as boron as taught by Wolf to be conventional practice, to produce an isolation trench that separates devices.

Response to Arguments

4. Applicant's arguments with respect to claims 8, 15, and 23-35 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

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§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (703)-306-9168 (after approximately 02/05/04 (7571-272-1687) and e-mail address is David.blum@USPTO.gov .

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached at (703)-308-4940. Our facsimile number all patent correspondence to be entered into an application is (703) 872-9306. The facsimile number for customer service is (703)-872-9317. Our receptionist's number is (703)-308-0956.

David S. Blum

December 17, 2003


ERIK J. KIELIN
PRIMARY EXAMINER